



Ventrex Evo3.1 CNG reducer Manual

SYSTEM VERSION	Ventrex Evo3.1 CNG reducer
DATE	16x-11-2020
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2 Manual updates / revision

Rev. nr	Rev. Date	Subject update
1	16-11-2020	1 st release



3 About this manual

This manual describes:

- Components description
- General diagnostics
- Service and maintenance
- General installation instructions

4 Approval numbers

For other system components use the general manual part 1 and the semi dedicated installation manual



Ventrex Evo3.1 CNG reducer: E1-110R02-00-0370-00

5 Ventrex Evo3.1 Electronic CNG Pressure Regulator



5.1 Function

- Reducing tank pressure (200 bar) to system pressure
- Absorbing sufficient heat to prevent ice formation
- Create a Flow and Pressure regulation
- Providing the engine with sufficient CNG across its entire load range

5.2 Specifications

- New-generation concept
 - ◆ 110kW / 150hp)
 - ◆ No diaphragm
- Housing
 - ◆ Lock-off valve integrated
 - ◆ Integrated safety pressure relief valve
- System pressure
 - ◆ Fully dynamic output pressure
 - ◆ Pressure adjustment by software
 - ◆ No pressure loss even at higher flows
 - ◆ No pressure drift over time
 - ◆ No pressure peaks during fuel cut-off
 - ◆
- Service and Maintenance
 - ◆ Reducer no maintenance needed
 - ◆ Prins filter 25.000 km / 2 year
- Installation / calibration
 - ◆ Two pole Superseal connector for actuator
 - ◆ Three pole high pressure tank sensor
 - ◆ OEM coolant temperature sensor
 - ◆ No need to adjust pressure manually

5.3 Technical Specifications

- Dual stage full electronic CNG pressure reducer
- Compressed Natural (CNG)
- Engine compartment installation
- 890g total weight
- 122,55 x 94,4 x 79,4 dimensions
- 20 to max. 260 bar input pressure (Abs.)
- 2 to max. 12 bar electronically adjustable output pressure (Abs.)
(software limited between 2 - 5,5 bar)
- >30 kg/h Max Fuel flow rate [at 5 bar]
- 8 bar pressure relieve valve
- -40 to +125°C operating temperatures
- Double ferrule 6mm Gas inlet
- 16mm Hose pillar gas outlet
- 8mm coolant connections
 - ◆ no flow direction specified
- Software controlled MAP Reference

5.4 Description

The Ventrex Evolution 3.1 is a state of the art full electronic reducer for the CNG market. It is designed for the usage in the supply system of CNG powered engines. The mechanic stage and the electronic proportional valve ensure the regulation of the working pressure. At the same time, the proportional valve acts as a shut-off valve.

The EPR contains two stages: a mechanical first stage and an electro-magnetic second stage (proportional valve). Additionally, a heat exchanger is part of the pressure regulator.

The proportional valve is controlled by a PWM signal (defined voltages), external from AFC.

The shut-off function is integrated in the electro-magnetic pressure regulation unit (proportional valve) as it is "normally closed".

The system pressure is managed by the calibration settings. The gas system pressure can be set by different strategies

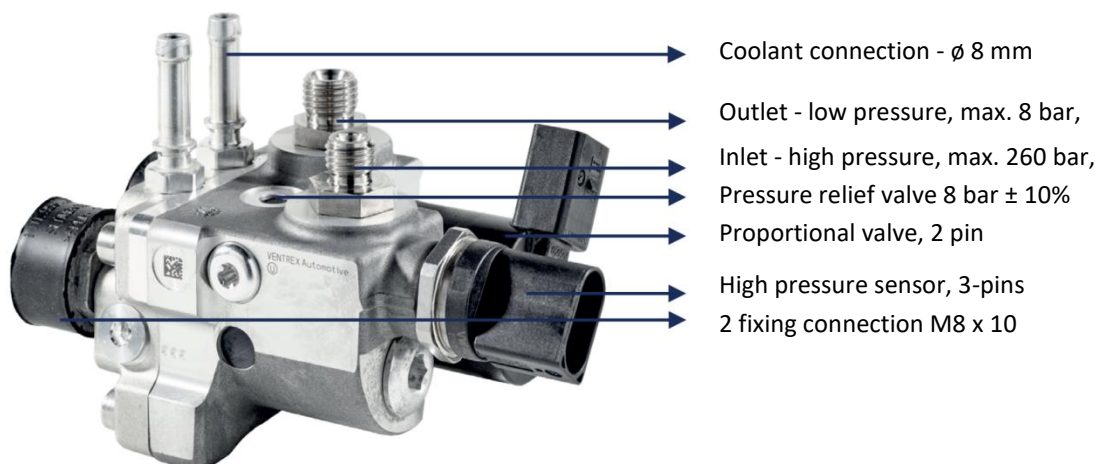
- 1) Constant pressure
- 2) Pressure related to the inlet manifold (Delta pressure)
- 3) Related to engine load / speed
- 4) Combination of delta pressure and engine speed / load

The target pressure can be read out with the Prins AFC Software v2.

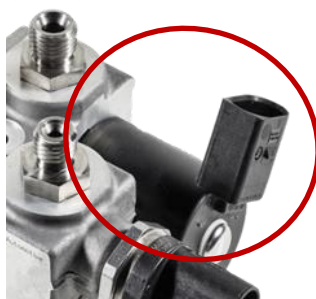
When the system pressure is related to the inlet manifold, the electronic MAP signal is used to manage the system pressure. The hose connection to the inlet manifold is used for the Pressure Relief Valve. No extra connection to the inlet manifold is needed to manage a Delta pressure.



5.5 Parts description



5.6 Proportional valve lock-off valve / Actuator (reducer)



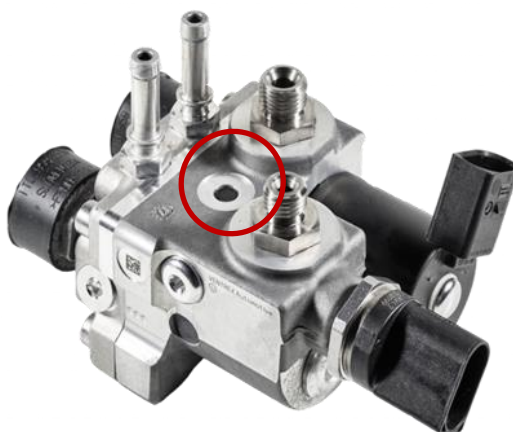
The lock-off valve is integrated in proportional valve. The proportional valve completely closes during engine off, driving on petrol and during fuel cut off.

5.7 High pressure sensor (tank pressure)



The pressure indicates the amount of CNG in the CNG tanks. The high pressure sensor measures the tank pressure between 0-260 bar. It's a 3-pole connector

5.8 Pressure relief safety valve (PRV)



Reducers must be equipped with a pressure relief valve to prevent excessive pressure. The pressure relief valve lowers the system pressure when it gets too high. It is not connected to the inlet manifold of the engine. The maximum relief pressure is 8 bar $\pm$ 0.8bar

5.9 Coolant connections



The reducer is connected to the coolant system with two 8mm heater hoses.

Use the (semi-) dedicated installation instructions for the correct coolant connections. When the information is not available, connect the reducer to a constant coolant flow hose.

5.10 Coolant temperature

The coolant temperature is measured from the OEM coolant temperature sensor. No temperature sensor is mounted in the Ventrex Evolution 3.1 CNG regulator.

5.11 Variant

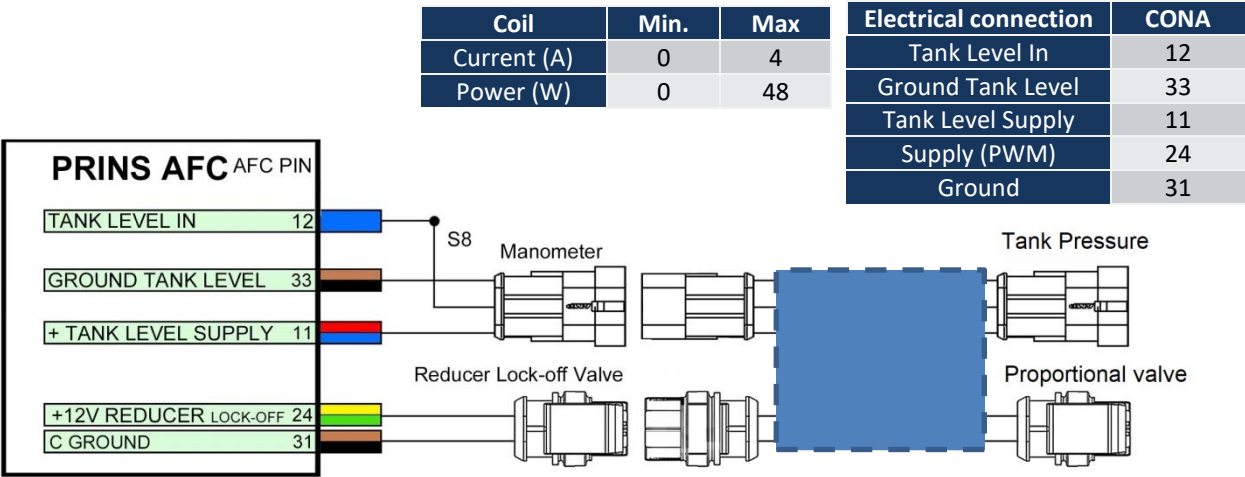
At the moment of writing, Prins uses a dedicated Prins Ventrex Evolution 3.1 version. This reducer is equipped with Prins dedicated connections.

6 Electrical connections

6.1 Wiring adapter

A special wiring adapter is needed to connect the electronic proportional valve and high pressure sensor to the wiring loom.

6.2 AFC-2.1 DI



7 Diagnostic

Fluctuation of system pressure during gas mode

The system gas pressure is measured with the P/T-sensor inside the Prins filter. The proportional valve is controlled depending on the deviation of the system pressure from the target pressure. This deviation depends on the gas flow. Use the process parameter SystemEPR_PressureErrorIAbsAvg6s [17396] to monitor the deviation.

SystemEPR_PressureErrorIAbsAvg6s (17396)

- Idle <25 [mbar]
- Part load <50 [mbar]
- Full load <100 [mbar]

Internal leakage Actuator valve DTC 236

When the AFC wakes up, the system gas pressure is measured. When this pressure is much higher than the pressure during engine shutdown, a DTC 236 can become active.

Switch back to petrol and the system pressure may not rise

Lower tank pressure after standstill

When the tank pressure is significant lower after a longer stand still, the system will set a faults code and will not switch over to gas.

Tank empty / Performance of the CNG reducer

The tank pressure can be a limiting

Reducer capacity

Heat capacity limit 30 kg/h @ 5bar

7.1 Prins AFC Software V2

Diagnostics - Process parameters

	Term	Explanation	Expected values	unit
17396	SystemEPR_PressureErrorIAbsAvg6s	Difference between expected value and real value.	Idle <25 Part load <50 Full load <100	mbar
15317	SystemEPR_TargetPressureLookUp	Expected pressure	500-3800	mbar
15303	SystemEPR_ActuatorVoltageCorrected	Supply voltage	0-12	V
76	Manifold Absolute Pressure (MAP)	Inlet manifold pressure	350-1000 (n.a.) 350- >1000 (super charged)	mbar
73	Gas Absolute Pressure	System gas pressure measured in the filter unit	500-5500	Mbar
487	Delta pressure	Pressure difference between Gas Absolute pressure and MAP pressure	800-2500	Mbar

8 Hardware installation instructions

8.1 Hardware installation

Mount the CNG Pressure Regulator:

- In the engine compartment as described in the (semi-) dedicated installation instructions.
- According to local regulations.
- With the delivered bracket.
- With use of the two rubber dampers.
- With use of the M8 bolts, nuts and spring lock washers delivered in the kit.



Tightening torques	Nm
Body mounting bolts	10
High pressure CNG hose	Hand tight +270°

8.2 Electrical installation

Electronic proportional valve

Connect the black 2 pole connector to the electronic proportional valve



High pressure sensor (tank pressure)

Connect the black 3 pole connector to the High pressure



8.3 Hoses installation

Coolant

Connect the coolant hoses to the coolant system of the vehicle.

- Fast temperature rising vehicle coolant hose
- No flow direction specified



CNG supply from tank

Connect the high pressure fuel supply line.



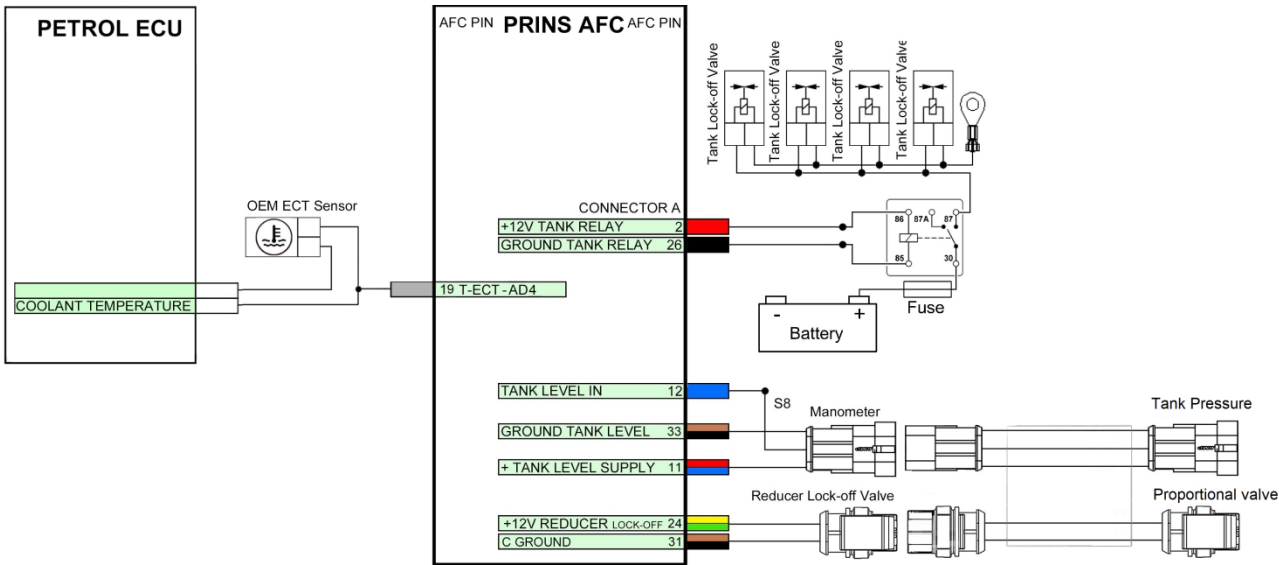
Gas output to filter

Connect the gas hose to the Gas-out and the inlet of the filter. Use the supplied clamps.

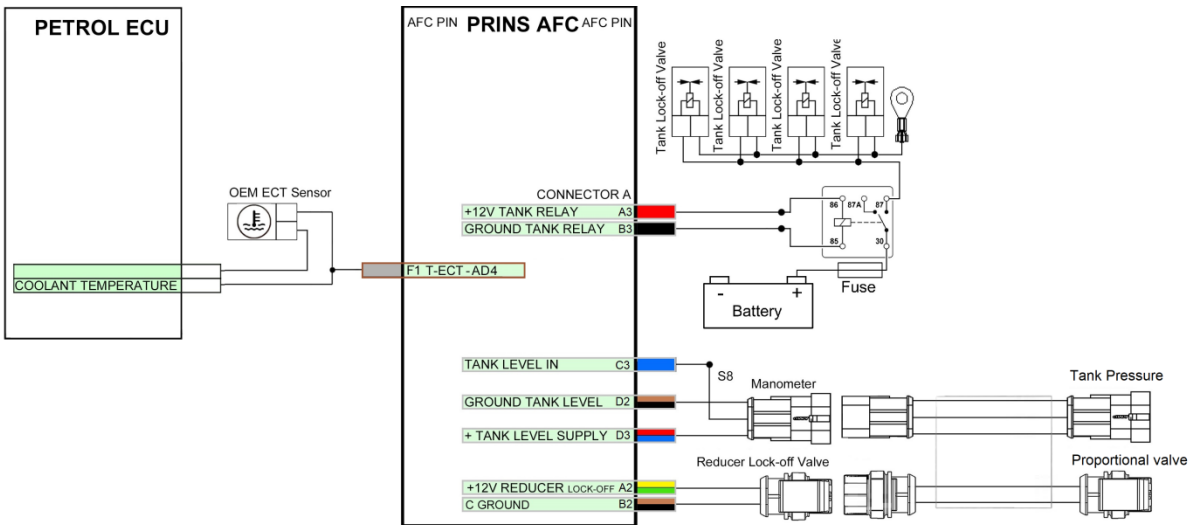


9 Basic wiring diagram

9.1 VSI-2.0 DI CNG



9.2 AFC-3.0 DI CNG



10 General installation instruction trunk side

Use the dedicated installation instructions



11 Commissioning

11.1 Checklist after installation

- 1) When working on the car, beware of moving, rotating parts and hot parts.
- 2) Fill-up the tank to a minimum tank level of 20%.
- 3) Install the main fuse; turn the ignition key in the ON position.
- 4) Prins AFC Software V2 program
 - a) Connect and run the Prins AFC Software v2 program.
 - b) Flash the correct firmware into the AFC.
 - c) Activate the AFC.
When the AFC has not been activated, the switch blinks white.
 - d) Start vehicle on petrol (system status "SS_Petrol_selected")
 - e) Check the engine signals, petrol injection time, RPM, ECT, MAP signal and petrol pressure signals.
 - f) Activate and set the service interval time (50km/h)
 - g) The system may switch over to CNG as soon as the temperature of the coolant becomes higher than parameter 62 - Switch over ECT.
- 5) Check all components and connections for any gas and fluid leakage (use a CNG leak detector device or a fluid detection like soap). Caution for moving and rotating parts in the engine compartment!
- 6) Let the engine run warm on petrol >80°C.
- 7) Check if the reducer heats up.
- 8) Check the vehicle and gas system for error codes and solve these, if required.
- 9) Create a log file during the test drive and judge the drivability on CNG and petrol.
 - a) Switch over behaviour Petrol -> CNG -> Petrol
 - b) Engine behaviour running cold and warm.
 - c) Shifting / changing gears.
 - d) The engine behaviour during and after a "fuel cut off", especially when falling back to idle rpm.
 - e) Stable idle, when pushing power steering to maximum limit and when shifting from park/neutral to gear and backwards.
- 10) Final check:
 - a) OBD- and AFC fault codes.
 - b) All installed components [hoses, wirings components].
 - c) Coolant level and the coolant connections, reducer and T-splices.
 - d) Gas & petrol leakages.
 - e) Disconnect the Prins AFC V2 software and place the protection connector on the VSI diagnostic connector.
- 11) Fill in Warranty Portal.
- 12) Fill in the Drivers Guide.
- 13) Handover the car, Drivers Guide and warranty certificate.



12 Service and maintenance

The Ventrex Evo3.1 does not need any service or maintenance. The Prins Filter unit needs to be replaced according the table on this page.

12.1 Interval and filter change



Replace the filter unit every 25.000km* or after 2years*.

* Depends on local conditions and gas quality.

12.2 Service items

Filter change:

- Filter unit.

Prins InjectorCare

- Add a bottle (200 ml) Prins InjectorCare in petrol tank

Check:

- Hoses:
 - ♦ Damage
 - ♦ Gas leaking
 - ♦ Engine coolant leakage
 - ♦ Petrol leakage
- Fastening of components.
- Electrical connections and wiring.
- VSI system error codes.
- Engine:
 - ♦ Error codes
 - ♦ Exhaust emissions.
 - ♦ Valve clearance
 - ♦ Ignition plugs
 - ♦ Ignition cables

12.3 Parts Replacement kit filter

Type	Picture example	Replacement filter unit	1x	Box of 50
Prins filter		PRINS 16X11 MM	180/802303/B Contact your distributor	Contact your distributor

12.4 Service time

12.4.1 Set service time

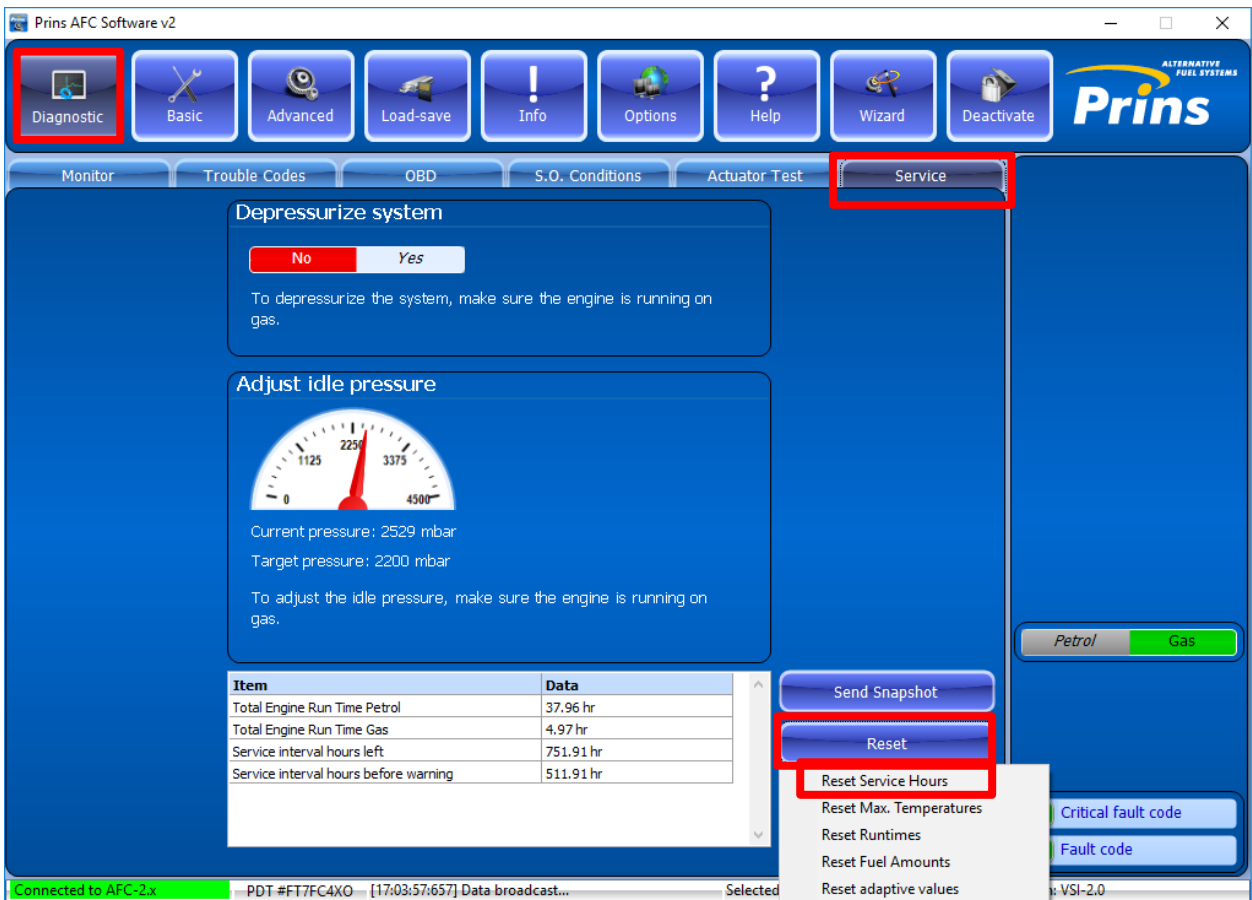
While driving on gas, the low pressure filter will collect impurities. After a certain time, this filter will need to be replaced. This time can be set with the Prins AFC software V2. The duration of saturation depends on the pollution of the gas and depends on the region. Prins handles 50km/h. 500 hours => 25.000 km. After the Service Interval Time has elapsed, the engine will only run on petrol.



ID	Name	Value	Unit	
2305	Service Interval Enable	Yes	-	✓
2306	Service Interval Maximum Time	752.00	hr	✓
2307	Service Interval Warn Time	512.00	hr	✓
4783	ServiceIntervalDTConNextDriveCycle	No	-	

12.4.2 Reset time

Reset the service time with the Prins AFC V2 Software.



The screenshot shows the Prins AFC Software v2 interface. The 'Diagnostic' button is highlighted in the top menu. The 'Service' tab is selected in the bottom menu. The 'Depressurize system' section has a 'No' button selected. The 'Adjust idle pressure' section shows a gauge with a needle pointing to 2250 mbar. The 'Current pressure' is 2529 mbar and the 'Target pressure' is 2200 mbar. The 'Service interval hours left' is 751.91 hr. The 'Service interval hours before warning' is 511.91 hr. The 'Reset' button is highlighted, and the 'Reset Service Hours' option is selected in the dropdown menu.

Item	Data
Total Engine Run Time Petrol	37.96 hr
Total Engine Run Time Gas	4.97 hr
Service interval hours left	751.91 hr
Service interval hours before warning	511.91 hr

Send Snapshot
Reset
Reset Service Hours
Reset Max. Temperatures
Reset Runtimes
Reset Fuel Amounts
Reset adaptive values

Connected to AFC-2x - PDT #FT7FC4XO - [17:03:57:657] Data broadcast... Selected

Critical fault code
Fault code
VSI-2.0

13 Trouble shooting

13.1 Way of working

The installer contacts the Prins importer when support is needed. The Prins importers have their own way of working with the installers.

Prins importers make use of the Prins Support Center. It's an online helpdesk application for communication between the importer and Prins HQ.

13.2 General

- If you can't solve the problem perform the basic checks
- Create log files with marks
- For complex diagnose:
 - ♦ 'Planning with customer, Installer, importer and Prins is needed'
 - ♦ 'Drive-in and solve problem, often not feasible or realistic'
 - ♦ Provide useful information
 - Customer complain
 - Good description of engine / vehicle behaviour
 - Log files of test drive
 - Reproduce behaviour - Mark
 - Gas & petrol modes
 - Deviating fuel trims
 - ♦ Check for new firmware

13.3 Basic checks

13.3.1 Engine does not run

- 1) Visual check :
 - a) Main fuse
 - b) Prins switch behaviour
 - c) Software in Master and Slave AFC?
-
- 2) Check with diagnostic tool
 - a) Diagnostic Trouble Codes AFC
 - b) OBD faults
 - c) Diagnostic parameters (Inputs)
 - i) Spare Input 1 Status [6299]
 - ii) Firing order [See installation manual]
 - (1) DI Engine Firing Order [11126]
 - (2) MPI Firing Order [14636]
 - iii) Petrol Injection time
 - iv) + ignition wire 112 [102]
 - v) RPM signal [101]
 - vi) Petrol High Pressure Absolute [537]
 - vii) Petrol Low Pressure Absolute [1171]
 - viii) Petrol Low Pressure Absolute Simulated [1317]
 - ix) OEM Sensor Ground Offset [3708]
 - x) OBD rail pressure (OBD page)



13.3.2 Engine does not run on CNG

- 1) Check with diagnostic tool
 - a) Switch over conditions not met
Diagnostic S.O. Conditions
 - b) System status
 - i) Switch over
 - ii) RPM, ECT, runtime, ...
 - iii) Firing order; not all injector present [DI-MPI]
 - (1) DI Engine Firing Order [11126]
 - (2) Secondary (MPI) Firing Order [14636]
 - c) GAS NOT ALLOWED
 - i) Main board temperature too high
 - ii) OBD External Tester Present [4650]
 - iii) Specific conditions ex. Idle, Reverse, ...
 - d) Empty Tank
- 2) Diagnostic Trouble Codes AFC
- 3) + ignition [102]; value 0 (or blinking 0-1-0-1)
- 4) RPM signal [101]; No signal

